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CLAIMS:

1.   An optical system comprising a diffraction element (2; 102; 202; 302) formed
of a substantially rigid first material having a first refractive index, the diffraction element
having:

a)   a first plurality of grooves (4; 104; 226) at a first interface of the diffraction
5   element with a second material (8; 108; 208) having a second refractive index; and

b)   a second, different, plurality of grooves (6; 106; 228) at a second, different,
interface of the diffraction element with a third material (10; 110; 210) having a third
refractive index,

wherein the first and second pluralities of grooves are aligned with respect to
10   each other such that a combined diffractive effect is achieved,

characterised in that the third material (10; 110; 210) is a liquid.

2.   An optical system according to claim 1, wherein said first plurality and said
second plurality of grooves (4; 104; 226), (6; 106; 228) are blazed and arranged to select a
15   desired diffraction order of a given input radiation.

3.   An optical system according to claim 1 or 2, wherein said first plurality of
grooves have a first depth (d_1), said second plurality of grooves have a second, different
depth (d_2), and wherein said first and second depths are different to each other.

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4.   An optical system according to claim 3, wherein said grooves are arranged to
fulfil the following relation:

$$- (n_1 - n_2)d_1 + (n_1 - n_3)d_2 = m\lambda_n$$

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wherein, n_1, n_2 and n_3 are the first, second and third refractive indices
respectively, d_1 and d_2 are the first and second depths respectively, m is a desired diffraction
order and λ_n is a wavelength of the given input radiation.

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5.   An optical system according to claim 4, wherein the given radiation beam comprises a plurality of different wavelengths λ_n and the grooves are arranged such that a diffraction efficiency η is substantially maximised for each of said different wavelengths λ_n, the efficiency η for each of said different wavelengths λ_n of the given input different radiation beam being given using the following relation:

$$\eta = \left(\frac{\sin\left[\frac{\pi(-(n_1 - n_2)d_1 + (n_1 - n_3)d_2)}{m\lambda_n} - \pi \right]}{\frac{\pi(-(n_1 - n_2)d_1 + (n_1 - n_3)d_2)}{m\lambda_n} - \pi} \right)^2$$

6.   An optical system according to any preceding claim, wherein said first plurality and said second plurality of grooves (4; 104; 226), (6; 106; 228) are arranged concentrically about an optical axis (OA).

7.   An optical system according to any preceding claim, wherein widths of said coinciding pairs are substantially the same, said widths being in a direction perpendicular the optical axis.

8.   An optical system according to any preceding claim, wherein the second material has a given optical dispersion and the third material has a different optical dispersion.

9.   An optical system according to any preceding claim, wherein said second material is a fluid.

10.   An optical system according claim 9, wherein said second material is a gas (8; 108; 208).

11.   An optical system according to any preceding claim, wherein said system is arranged to modify a configuration of said third material using electrowetting forces.

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12.   A method of manufacturing an optical system comprising a diffraction element (2; 102; 202; 302) formed of a substantially rigid first material having a first refractive index, the diffraction element, when manufactured, comprising:

a)   a first plurality of grooves (4; 104; 226) at a first interface of the diffraction element with with a second material (8; 108; 208) having a second refractive index; and

b)   a second plurality of grooves (6; 106; 228) at a second interface of the diffraction element with a third material (10; 110; 210) having a third, different, refractive index,

wherein the first and second pluralities of grooves are aligned with respect to each other such that a combined diffractive effect is achieved,

the method comprising applying said second material to said first plurality of grooves,

characterised in that the method comprises applying said third material (10; 110; 210) to said second plurality of grooves as a liquid.